

## PATENT ABSTRACTS OF JAPAN

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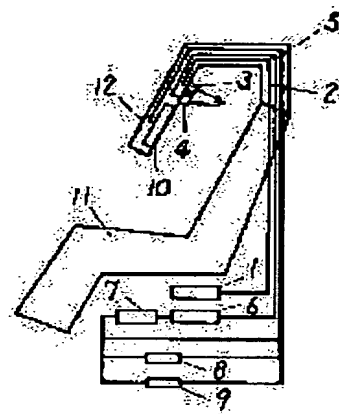
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## (54) BIOFEEDBACK DEVICE

## (57)Abstract:

**PURPOSE:** To provide the relatively inexpensive biofeedback device which eliminates an odd feel by electrode mounting.

**CONSTITUTION:** This biofeedback device consists of an irradiation section 3 for irradiating a living body with an electromagnetic wave having a certain characteristic, a photodetecting section 4 which detects the reflection wave from the living body of the cast electromagnetic wave, a blood flow rate calculating section 7 which converts the detection signal from this photodetecting section 4 to information of a specific characteristic and an information presenting means for presenting the information to the living body. The living body is irradiated with the electromagnetic wave, such as, for example, laser beam, and a feedback signal is outputted according to the characteristics of the reflected wave, by which feedback training is executed and, therefore, the odd feel by electrode mounting \$ experienced heretofore is eliminated and further, the use of a costly device such as SQUID like heretofore is eliminated.



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**CLAIMS**

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**[Claim(s)]**

[Claim 1] Biofeedback equipment which consists of an electromagnetic wave exposure means to irradiate the electromagnetic wave which had a certain property to the living body, an electromagnetic wave detection means to detect the reflected wave from the living body of the irradiated electromagnetic wave, a signal transduction means to change the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means to show said information to said living body.

[Claim 2] An electromagnetic wave exposure means is biofeedback equipment according to claim 1 with the laser light generating section.

[Claim 3] A signal transduction means is biofeedback equipment according to claim 1 with the blood stream operation part which calculates a living body's blood stream based on the detecting signal from an electromagnetic wave detection means.

[Claim 4] An information presentation means is biofeedback equipment according to claim 1 with the storage section which memorizes the output from a signal transduction means.

[Claim 5] An information presentation means is biofeedback equipment according to claim 1 with the integral section which integrates with the output from a signal transduction means.

[Claim 6] A signal transduction means is biofeedback equipment according to claim 1 with the oxygen density operation part which calculates an oxygen density in the living body based on the detecting signal from an electromagnetic wave detection means.

[Claim 7] An electromagnetic wave exposure means is biofeedback equipment according to claim 1 with the light generating section.

[Claim 8] An electromagnetic wave detection means is biofeedback equipment according to claim 1 which detects the transmitted wave from the living body of the irradiated electromagnetic wave.

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the biofeedback equipment which promotes a living body's relaxation, cerebral activation, etc.

[0002]

[Description of the Prior Art] Conventionally, like JP,2-168934,A, this kind of biofeedback equipment equipped a living body's head 2 with the electroencephalogram electrode, passed selectively only the frequency component predetermined with a band-pass filter, and had conducted the luminous stimulus to the living body, corresponding to the output signal of a band-pass filter. Moreover, in JP,2-168935,A, in order to avoid the sense of incongruity by the above electrode wearing, it was feeding back, without sticking an electrode on a direct living body side by detecting a brain magnetic wave using SQUID which used the superconduction film.

[0003]

[Problem(s) to be Solved by the Invention] However, about the biofeedback equipment of the above-mentioned technique, in the 1st example of a citation, on the need of ensuring electric contact to an electrode and a living body side, the paste etc. had to be attached, the direct living body front face had to be equipped with the electrode, and the technical problem that wearing was troublesome and there was moreover sense of incongruity occurred. Moreover, in the 2nd example of a citation, the technical problem that SQUID is very expensive and that it was not practical occurred. Furthermore, as an operating environment, respectively electric or magnetic shield room was needed, and both examples of a citation had the technical problem were user-unfriendly.

[0004] The object of 1 of this invention does not have the sense of incongruity by the above electrode wearing, and is to offer comparatively cheap biofeedback equipment.

[0005] Moreover, the 2nd object of this invention is to raise the user-friendliness of equipment.

[0006]

[Means for Solving the Problem] This invention consists of an electromagnetic wave exposure means irradiate the electromagnetic wave which had a certain property to the living body, an electromagnetic wave detection means detect the reflected wave from the living body of the irradiated electromagnetic wave, a signal-transduction means change the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means show said information to said living body, in order to attain the 1st above-mentioned object.

[0007] Moreover, in order that this invention may attain the 2nd object of the above, an electromagnetic wave exposure means has the laser light generating section.

[0008] Moreover, this invention has the blood stream operation part to which a signal transduction means calculates a living body's blood stream based on the detecting signal from an electromagnetic wave detection means, in order to attain the 2nd object of the above.

[0009] Moreover, this invention has the storage section an information presentation means remembers the output from a signal transduction means to be, in order to attain the 2nd object

of the above.

[0010] Moreover, this invention has the integral section which an information presentation means integrates with the output from a signal transduction means, in order to attain the 2nd object of the above.

[0011] Moreover, this invention has the oxygen density operation part to which a signal transduction means calculates an oxygen density in the living body based on the detecting signal from an electromagnetic wave detection means, in order to attain the 2nd object of the above.

[0012] Moreover, in order that this invention may attain the 2nd object of the above, an electromagnetic wave exposure means has the light generating section.

[0013] Furthermore, this invention detects the transmitted wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated, in order to attain the 2nd object of the above.

[0014]

[Function] This invention acts as follows by the above-mentioned configuration.

[0015] If the electromagnetic wave in which the electromagnetic wave exposure means had a certain property to the living body is irradiated, the reflected wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated will be detected, signal transduction will change the detecting signal from said electromagnetic wave detection means into a certain specific information, and a news presentation means will present said information to said living body.

[0016] Moreover, the laser light generating section of an electromagnetic wave exposure means generates laser light, the reflected wave from the living body of the laser light by which the electromagnetic wave detection means was irradiated is detected, a signal transduction means changes the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means presents said information to said living body.

[0017] Moreover, the blood stream operation part of a signal transduction means calculates a living body's blood stream based on the detecting signal from an electromagnetic wave detection means, and an information presentation means presents said blood stream to said living body.

[0018] Moreover, the storage section of an information presentation means memorizes the output from a signal transduction means, and this invention presents the time series information on said output to a living body.

[0019] Moreover, the integral section of an information presentation means integrates with the output from a signal transduction means, and presents the integral value of said output to a living body.

[0020] Moreover, the oxygen density operation part of a signal transduction means calculates an oxygen density in the living body based on the detecting signal from an electromagnetic wave detection means, and an information presentation means presents said oxygen density to said living body.

[0021] Moreover, the reflected wave from the living body of the electromagnetic wave which irradiates the light which the light generating section of an electromagnetic wave exposure means generated at a living body and by which the electromagnetic wave detection means was irradiated is detected, signal transduction changes the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means presents said information to said living body.

[0022] If the electromagnetic wave in which the electromagnetic wave exposure means furthermore had a certain property to the living body is irradiated, the transmitted wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated will be detected, signal transduction will change the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means will present said information to said living body.

[0023]

[Example] The example of this invention is explained based on a drawing below. Drawing 1 is a block diagram at the time of including this example in an easy chair. In drawing 1, an

electromagnetic wave exposure means consists of the laser light generating section 1, an optical fiber 2 which transmits laser light, and the exposure section 3 which irradiates laser light. The laser light generating section 1 is using semiconductor laser in consideration of small and a light weight, and the point of being cheap. An electromagnetic wave detection means consists of a light sensing portion 4 of a reflected wave, an optical fiber 5 which transmits the received light, and a photodiode 6. A signal transduction means consists of blood stream operation part 7 which calculates a living body's blood stream based on the detecting signal from a light sensing portion 4. An information presentation means consists of displays 10 which display the time series value and said integral value of the blood stream remembered to be a certain integral section 9 which carries out fixed time quadrature, and the real-time value of a blood stream in the storage section 8 which memorizes the calculated blood stream serially, and the calculated blood stream. The exposure section 3 and a light sensing portion 4 are installed in the head hood 12 of an easy chair 11.

[0024] The operation by the configuration of the above-mentioned example is explained below. If a user takes a seat to an easy chair 11, the laser light generated in the laser light generating section 1 will be irradiated by the regio frontalis capitis from the exposure section 3 through an optical fiber 2. The laser luminous intensity used here has reduced reinforcement to extent which does not do an adverse effect to a living body enough. Generally, if laser light is irradiated by the body tissue, the part irradiated by the blood which is flowing during the organization will receive a Doppler shift according to a flow velocity, and wavelength will change. And a part of carrier beam light become irregular is equivalent to a flow velocity in a Doppler shift, it is carried out and the blood stream of the organization concerned is calculated that the luminous intensity is equivalent to the blood volume which is moving, then by calculating the product of these flow velocities and blood volume. Therefore, based on the above-mentioned procedure, the blood stream of a head calculates by the blood stream operation part 7 based on the relation of drawing 2. The calculated blood stream signal is outputted as a picture signal according to the signal level on a display 10. For example, as shown in drawing 3, a user can perform feedback training on real time so that the height of a bar may go into each field on a screen for the magnitude of a blood stream is displayed in the height of a bar and attaining relaxation or activation. Moreover, a blood stream signal is serially memorized by the storage section 8, and stored data can be displayed on a display 10 at the event of arbitration. For example, as shown in drawing 4, time amount is taken along an axis of abscissa, a blood stream is taken along an axis of ordinate, and said stored data is displayed on the coordinate plane. Since not only training on real time but a serial check can thereby be performed, it can contribute to the improvement in results of feedback training. Furthermore, it integrates with a blood stream signal during a certain 1 scheduled time by the integral section 9, and this integral value is displayed on a display 10. For example, if the integral value of the blood stream from the equipment beginning of using is displayed as shown in drawing 5, the active state of the brain of the training period etc. can be checked, and although it is not the decision ingredient to next training, i.e., real time, it will become the effective information as feedback training by the somewhat long span.

[0025] Since there is no sense of incongruity by electrode wearing like before since an electromagnetic wave is irradiated at a living body, a feedback signal is outputted according to the property of the reflected wave and biofeedback training is performed in the state of non-contact according to the above-mentioned operation, and expensive equipment like SQUID is not used still like before, it is effective in the ability to offer practical biofeedback equipment.

[0026] Moreover, since the electromagnetic wave exposure means consists of the laser light generating sections like semiconductor laser, it has small and the effectiveness that it is unnecessary and user-friendliness of electric magnetic shielding like before improves, on the occasion of the activity of equipment rather than the conventional SQUID while it is lightweight and cheap.

[0027] Moreover, since the size of a blood stream expresses the activity degree of the organization, outputs a feedback signal according to the blood stream which calculated and calculated a living body's blood stream based on the reflected wave of the laser light irradiated by the living body and performs feedback training, it is necessary to detect neither a direct

electroencephalogram nor a brain magnetic wave like before, and effective in user-friendliness improving.

[0028] Moreover, since the time series information memorized with the information presentation means is displayed, and not only training on real time but a serial check can be performed, it is effective in the ability to contribute to the improvement in results of feedback training.

[0029] Furthermore, since the integral information calculated with the information presentation means is displayed, the active state of the living body of a training period etc. can be checked, for example, and although it is not the decision ingredient to next training, i.e., real time, it is effective in becoming the effective information as feedback training by the somewhat long span.

[0030] Although the signal transduction means was constituted from the blood stream operation part 7 which calculates a living body's blood stream based on the detecting signal from a light sensing portion 4 by the above-mentioned example, it is good also as a configuration with the oxygen density operation part to which a signal transduction means calculates the oxygen density in blood based on the detecting signal from a light sensing portion 4. By choosing the wavelength of laser light, a part of laser light which irradiated the living body is absorbed by the hemoglobin in the blood in a body tissue, and this is based on the reinforcement of the reflected light changing. A near infrared ray is used as a laser light. The relation between the oxygen density in blood and luminous intensity is shown in drawing 6. Since it is thought that the oxygen density in blood expresses the activity degree of the cell into which blood flows, an activity degree can only be well reflected [ rather than ] using a blood stream. When following, for example, raising the activity of the brain under mental work, or when making to raise the activity degree of the living body like dotage prevention into the object of training, it is effective in the ability to perform training with the more effective configuration of outputting the feedback signal according to an oxygen density as mentioned above than the configuration using a blood stream.

[0031] Moreover, although laser light was used as an electromagnetic wave in the above-mentioned example, there are that it is good also as a configuration which irradiates not only laser light but the light etc. at a living body, and outputs a feedback signal based on the property of the reflected light, and a configuration is easier than the configuration which generates laser light and insurance, and effectiveness of being cheap and more practical.

[0032] Moreover, in the above-mentioned example, although the electromagnetic wave detection means was the configuration of detecting the reflected wave of the irradiated electromagnetic wave, it is good also as a configuration which detects the transmitted wave of the electromagnetic wave by which the electromagnetic wave detection means was irradiated. Although only the biological information of a living body front face like a skin blood flow and a living body surface is detectable with the configuration which detects a reflected wave, for example, with the configuration which detects a transmitted wave Since it is detectable to the biological information of the living body depths like the activity degree of not only a living body front face but internal organs, or a depths blood flow For example, when making to raise the activity of internal organs for digestive acceleration or a constipation dissolution into the object of training, it is effective in the ability to perform training with the more effective configuration of using the above transmitted waves than the configuration which detects a reflected wave.

[0033] Moreover, in the above-mentioned example, although the exposure section 3 and a light sensing portion 4 were installed in the head hood 12 of an easy chair 11, the exposure section 3 and a light sensing portion 4 may be installed in the height 14 of the headrest 13 of an easy chair 11, as shown in drawing 7, and an electromagnetic wave is irradiated and is made by the same feedback training as the above at the regio occipitalis capitis based on the reflected wave.

[0034] Moreover, it is good also as a configuration which did not include this example in an easy chair 11, but was included in the bedding of a bolster 15 or pad 16 grade, the organ bath 17, and the seat 18 grade as shown in the chair of a sofa or a vehicle and drawing 8 - drawing 10.

Moreover, it is good also as a configuration of the pocket mold which arranged the exposure section 3 and a light sensing portion 4 in the hair band 19 as shown in drawing 11, and contained the laser photoluminescence section 1, the photodiode 6, the signal transduction means, and the information presentation means of display 10 grade in the compact control unit 20.

[0035] Moreover, the part which irradiates an electromagnetic wave is good also as a configuration which does not limit to a head as mentioned above and irradiates the hand part which are other suitable parts of a living body, for example, the part which the deletion blood vessel was developed and was suitable for feedback training, and the fingertip section.

[0036] Furthermore, although it was the configuration which displays feedback signals, such as a blood stream, on a display 10 in the above-mentioned example, you may be the configuration of showing a feedback signal as a sound signal by the loudspeaker, or showing it by the flash of LED.

[0037]

[Effect of the Invention] According to the biofeedback equipment of this invention, the following effectiveness is acquired as explained above.

[0038] (1) Since there is no sense of incongruity by electrode wearing like before since an electromagnetic wave is irradiated at a living body, a feedback signal is outputted according to the property of the reflected wave and biofeedback training is performed in the state of non-contact, and expensive equipment like SQUID is not used still like before, it is effective in the ability to offer practical biofeedback equipment.

[0039] (2) Since the electromagnetic wave exposure means consists of the laser light generating sections like semiconductor laser, it has small and the effectiveness that it is unnecessary and user-friendliness of electric magnetic shielding like before improves, on the occasion of the activity of equipment rather than the conventional SQUID while it is lightweight and cheap.

[0040] (3) Since the size of a blood stream expresses the activity degree of the organization, outputs a feedback signal according to the blood stream which calculated and calculated a living body's blood stream based on the reflected wave of the laser light irradiated by the living body and performs feedback training, it is necessary to detect neither a direct electroencephalogram nor a brain magnetic wave like before, and effective in user-friendliness improving.

[0041] (4) Since the time series information memorized with the information presentation means is displayed, and not only training on real time but a serial check can be performed, it is effective in the ability to contribute to the improvement in results of feedback training.

[0042] (5) Since the integral information calculated with the information presentation means is displayed, the active state of the living body of a training period etc. can be checked, for example, and although it is not the decision ingredient to next training, i.e., real time, it is effective in becoming the effective information as feedback training by the somewhat long span.

[0043] (6) From it being thought that the oxygen density in blood expresses the activity degree of the cell into which blood flows Since a feedback signal is outputted according to the oxygen density which calculated and calculated the oxygen density in a living body's blood based on the reflected wave of the laser light irradiated by the living body and feedback training is performed While it is effective in detecting neither a direct electroencephalogram nor a brain magnetic wave like before, and user-friendliness improving Since an activity degree can only be well reflected [ rather than ] using a blood stream For example, when raising the activity of the brain under mental work, or when making to raise the activity degree of the living body like dotage prevention into the object of training, it is effective in the ability to perform more effective training than the configuration which uses a blood stream.

[0044] (7) When it is the configuration which irradiates not only laser light but the light at a living body as an electromagnetic wave to irradiate, and outputs a feedback signal based on the property of the reflected light, since it is cheap, there are that a configuration is easier than the configuration which generates laser light and insurance, and effectiveness of being more practical.

[0045] (8) If it is the configuration which detects the transmitted wave of the electromagnetic wave by which the electromagnetic wave detection means was irradiated, with the configuration which detects a reflected wave for example, although only the biological information of a living body front face like a skin blood flow and a living body surface is detectable, with the configuration which detects a transmitted wave Since it is detectable to the biological information of the living body depths like the activity degree of not only a living body front face but internal organs, or a depths blood flow For example, when making to raise the activity of



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**TECHNICAL FIELD**

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PRIOR ART

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## EFFECT OF THE INVENTION

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**TECHNICAL PROBLEM**

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[Problem(s) to be Solved by the Invention] However, about the biofeedback equipment of the above-mentioned technique, in the 1st example of a citation, on the need of ensuring electric contact to an electrode and a living body side, the paste etc. had to be attached, the direct living body front face had to be equipped with the electrode, and the technical problem that wearing was troublesome and there was moreover sense of incongruity occurred. Moreover, in the 2nd example of a citation, the technical problem that SQUID is very expensive and that it was not practical occurred. Furthermore, as an operating environment, respectively electric or magnetic shield room was needed, and both examples of a citation had the technical problem were user-unfriendly.

[0004] The object of 1 of this invention does not have the sense of incongruity by the above electrode wearing, and is to offer comparatively cheap biofeedback equipment.

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**MEANS**

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[Means for Solving the Problem] This invention consists of an electromagnetic wave exposure means irradiate the electromagnetic wave which had a certain property to the living body, an electromagnetic wave detection means detect the reflected wave from the living body of the irradiated electromagnetic wave, a signal-transduction means change the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means show said information to said living body, in order to attain the 1st above-mentioned object.

[0007] Moreover, in order that this invention may attain the 2nd object of the above, an electromagnetic wave exposure means has the laser light generating section.

[0008] Moreover, this invention has the blood stream operation part to which a signal transduction means calculates a living body's blood stream based on the detecting signal from an electromagnetic wave detection means, in order to attain the 2nd object of the above.

[0009] Moreover, this invention has the storage section an information presentation means remembers the output from a signal transduction means to be, in order to attain the 2nd object of the above.

[0010] Moreover, this invention has the integral section which an information presentation means integrates with the output from a signal transduction means, in order to attain the 2nd object of the above.

[0011] Moreover, this invention has the oxygen density operation part to which a signal transduction means calculates an oxygen density in the living body based on the detecting signal from an electromagnetic wave detection means, in order to attain the 2nd object of the above.

[0012] Moreover, in order that this invention may attain the 2nd object of the above, an electromagnetic wave exposure means has the light generating section.

[0013] Furthermore, this invention detects the transmitted wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated, in order to attain the 2nd object of the above.

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## OPERATION

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[Function] This invention acts as follows by the above-mentioned configuration.

[0015] If the electromagnetic wave in which the electromagnetic wave exposure means had a certain property to the living body is irradiated, the reflected wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated will be detected, signal transduction will change the detecting signal from said electromagnetic wave detection means into a certain specific information, and a news presentation means will present said information to said living body.

[0016] Moreover, the laser light generating section of an electromagnetic wave exposure means generates laser light, the reflected wave from the living body of the laser light by which the electromagnetic wave detection means was irradiated is detected, a signal transduction means changes the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means presents said information to said living body.

[0017] Moreover, the blood stream operation part of a signal transduction means calculates a living body's blood stream based on the detecting signal from an electromagnetic wave detection means, and an information presentation means presents said blood stream to said living body.

[0018] Moreover, the storage section of an information presentation means memorizes the output from a signal transduction means, and this invention presents the time series information on said output to a living body.

[0019] Moreover, the integral section of an information presentation means integrates with the output from a signal transduction means, and presents the integral value of said output to a living body.

[0020] Moreover, the oxygen density operation part of a signal transduction means calculates an oxygen density in the living body based on the detecting signal from an electromagnetic wave detection means, and an information presentation means presents said oxygen density to said living body.

[0021] Moreover, the reflected wave from the living body of the electromagnetic wave which irradiates the light which the light generating section of an electromagnetic wave exposure means generated at a living body and by which the electromagnetic wave detection means was irradiated is detected, signal transduction changes the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means presents said information to said living body.

[0022] If the electromagnetic wave in which the electromagnetic wave exposure means furthermore had a certain property to the living body is irradiated, the transmitted wave from the living body of the electromagnetic wave by which the electromagnetic wave detection means was irradiated will be detected, signal transduction will change the detecting signal from said electromagnetic wave detection means into a certain specific information, and an information presentation means will present said information to said living body.

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EXAMPLE

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[Example] The example of this invention is explained based on a drawing below. Drawing 1 is a block diagram at the time of including this example in an easy chair. In drawing 1, an electromagnetic wave exposure means consists of the laser light generating section 1, an optical fiber 2 which transmits laser light, and the exposure section 3 which irradiates laser light. The laser light generating section 1 is using semiconductor laser in consideration of small and a light weight, and the point of being cheap. An electromagnetic wave detection means consists of a light sensing portion 4 of a reflected wave, an optical fiber 5 which transmits the received light, and a photodiode 6. A signal transduction means consists of blood stream operation part 7 which calculates a living body's blood stream based on the detecting signal from a light sensing portion 4. An information presentation means consists of displays 10 which display the time series value and said integral value of the blood stream remembered to be a certain integral section 9 which carries out fixed time quadrature, and the real-time value of a blood stream in the storage section 8 which memorizes the calculated blood stream serially, and the calculated blood stream. The exposure section 3 and a light sensing portion 4 are installed in the head hood 12 of an easy chair 11.

[0024] The operation by the configuration of the above-mentioned example is explained below. If a user takes a seat to an easy chair 11, the laser light generated in the laser light generating section 1 will be irradiated by the regio frontalis capitis from the exposure section 3 through an optical fiber 2. The laser luminous intensity used here has reduced reinforcement to extent which does not do an adverse effect to a living body enough. Generally, if laser light is irradiated by the body tissue, the part irradiated by the blood which is flowing during the organization will receive a Doppler shift according to a flow velocity, and wavelength will change. And a part of carrier beam light become irregular is equivalent to a flow velocity in a Doppler shift, it is carried out and the blood stream of the organization concerned is calculated that the luminous intensity is equivalent to the blood volume which is moving, then by calculating the product of these flow velocities and blood volume. Therefore, based on the above-mentioned procedure, the blood stream of a head calculates by the blood stream operation part 7 based on the relation of drawing 2. The calculated blood stream signal is outputted as a picture signal according to the signal level on a display 10. For example, as shown in drawing 3, a user can perform feedback training on real time so that the height of a bar may go into each field on a screen for the magnitude of a blood stream is displayed in the height of a bar and attaining relaxation or activation. Moreover, a blood stream signal is serially memorized by the storage section 8, and stored data can be displayed on a display 10 at the event of arbitration. For example, as shown in drawing 4, time amount is taken along an axis of abscissa, a blood stream is taken along an axis of ordinate, and said stored data is displayed on the coordinate plane. Since not only training on real time but a serial check can thereby be performed, it can contribute to the improvement in results of feedback training. Furthermore, it integrates with a blood stream signal during a certain 1 scheduled time by the integral section 9, and this integral value is displayed on a display 10. For example, if the integral value of the blood stream from the equipment beginning of using is displayed as shown in drawing 5, the active state of the brain of the training period etc. can be checked, and although it is not the decision ingredient to next training, i.e., real time, it

will become the effective information as feedback training by the somewhat long span.

[0025] Since there is no sense of incongruity by electrode wearing like before since an electromagnetic wave is irradiated at a living body, a feedback signal is outputted according to the property of the reflected wave and biofeedback training is performed in the state of non-contact according to the above-mentioned operation, and expensive equipment like SQUID is not used still like before, it is effective in the ability to offer practical biofeedback equipment.

[0026] Moreover, since the electromagnetic wave exposure means consists of the laser light generating sections like semiconductor laser, it has small and the effectiveness that it is unnecessary and user-friendliness of electric magnetic shielding like before improves, on the occasion of the activity of equipment rather than the conventional SQUID while it is lightweight and cheap.

[0027] Moreover, since the size of a blood stream expresses the activity degree of the organization, outputs a feedback signal according to the blood stream which calculated and calculated a living body's blood stream based on the reflected wave of the laser light irradiated by the living body and performs feedback training, it is necessary to detect neither a direct electroencephalogram nor a brain magnetic wave like before, and effective in user-friendliness improving.

[0028] Moreover, since the time series information memorized with the information presentation means is displayed, and not only training on real time but a serial check can be performed, it is effective in the ability to contribute to the improvement in results of feedback training.

[0029] Furthermore, since the integral information calculated with the information presentation means is displayed, the active state of the living body of a training period etc. can be checked, for example, and although it is not the decision ingredient to next training, i.e., real time, it is effective in becoming the effective information as feedback training by the somewhat long span.

[0030] Although the signal transduction means was constituted from the blood stream operation part 7 which calculates a living body's blood stream based on the detecting signal from a light sensing portion 4 by the above-mentioned example, it is good also as a configuration with the oxygen density operation part to which a signal transduction means calculates the oxygen density in blood based on the detecting signal from a light sensing portion 4. By choosing the wavelength of laser light, a part of laser light which irradiated the living body is absorbed by the hemoglobin in the blood in a body tissue, and this is based on the reinforcement of the reflected light changing. A near infrared ray is used as a laser light. The relation between the oxygen density in blood and luminous intensity is shown in drawing 6. Since it is thought that the oxygen density in blood expresses the activity degree of the cell into which blood flows, an activity degree can only be well reflected [ rather than ] using a blood stream. When following, for example, raising the activity of the brain under mental work, or when making to raise the activity degree of the living body like dotage prevention into the object of training, it is effective in the ability to perform training with the more effective configuration of outputting the feedback signal according to an oxygen density as mentioned above than the configuration using a blood stream.

[0031] Moreover, although laser light was used as an electromagnetic wave in the above-mentioned example, there are that it is good also as a configuration which irradiates not only laser light but the light etc. at a living body, and outputs a feedback signal based on the property of the reflected light, and a configuration is easier than the configuration which generates laser light and insurance, and effectiveness of being cheap and more practical.

[0032] Moreover, in the above-mentioned example, although the electromagnetic wave detection means was the configuration of detecting the reflected wave of the irradiated electromagnetic wave, it is good also as a configuration which detects the transmitted wave of the electromagnetic wave by which the electromagnetic wave detection means was irradiated.

Although only the biological information of a living body front face like a skin blood flow and a living body surface is detectable with the configuration which detects a reflected wave, for example, with the configuration which detects a transmitted wave Since it is detectable to the biological information of the living body depths like the activity degree of not only a living body front face but internal organs, or a depths blood flow For example, when making to raise the

activity of internal organs for digestive acceleration or a constipation dissolution into the object of training, it is effective in the ability to perform training with the more effective configuration of using the above transmitted waves than the configuration which detects a reflected wave.

[0033] Moreover, in the above-mentioned example, although the exposure section 3 and a light sensing portion 4 were installed in the head hood 12 of an easy chair 11, the exposure section 3 and a light sensing portion 4 may be installed in the height 14 of the headrest 13 of an easy chair 11, as shown in drawing 7 , and an electromagnetic wave is irradiated and is made by the same feedback training as the above at the regio occipitalis capitis based on the reflected wave.

[0034] Moreover, it is good also as a configuration which did not include this example in an easy chair 11, but was included in the bedding of a bolster 15 or pad 16 grade, the organ bath 17, and the seat 18 grade as shown in the chair of a sofa or a vehicle and drawing 8 - drawing 10 .

Moreover, it is good also as a configuration of the pocket mold which arranged the exposure section 3 and a light sensing portion 4 in the hair band 19 as shown in drawing 11 , and contained the laser photoluminescence section 1, the photodiode 6, the signal transduction means, and the information presentation means of display 10 grade in the compact control unit 20.

[0035] Moreover, the part which irradiates an electromagnetic wave is good also as a configuration which does not limit to a head as mentioned above and irradiates the hand part which are other suitable parts of a living body, for example, the part which the deletion blood vessel was developed and was suitable for feedback training, and the fingertip section.

[0036] Furthermore, although it was the configuration which displays feedback signals, such as a blood stream, on a display 10 in the above-mentioned example, you may be the configuration of showing a feedback signal as a sound signal by the loudspeaker, or showing it by the flash of LED.

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[Translation done.]

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**DESCRIPTION OF DRAWINGS**

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**[Brief Description of the Drawings]**

**[Drawing 1]** The block diagram of the biofeedback equipment in the example of this invention

**[Drawing 2]** Drawing having shown the relation between luminous intensity, a part become irregular, and a blood stream

**[Drawing 3]** Drawing having shown an example of a display of the blood stream in the information presentation means of this example

**[Drawing 4]** Drawing having shown an example of a time series display of the blood stream in the information presentation means of this example

**[Drawing 5]** Drawing having shown an example of the integral representation of the blood stream in the information presentation means of this example

**[Drawing 6]** Drawing having shown the relation between luminous intensity and an oxygen density

**[Drawing 7]** The appearance perspective view in the example at the time of including this invention in a headrest

**[Drawing 8]** The appearance perspective view in the example at the time of including this invention in bedding

**[Drawing 9]** The appearance perspective view in the example at the time of including this invention in an organ bath

**[Drawing 10]** The appearance perspective view in the example at the time of including this invention in the seat

**[Drawing 11]** The appearance perspective view in the example at the time of using this invention as a pocket mold

**[Description of Notations]**

1 Laser Light Generating Section

2 Optical Fiber

3 Exposure Section

4 Light Sensing Portion

5 Optical Fiber

6 Photodiode

7 Blood Stream Operation Part

8 Storage Section

9 Integral Section

10 Display

11 Easy Chair

12 Head Hood

13 Headrest

14 Height

15 Bolster

16 Pad

17 Organ Bath

18 Seat

19 Band for Hair  
20 Control Unit

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[Translation done.]

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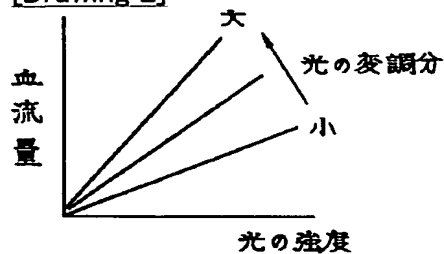
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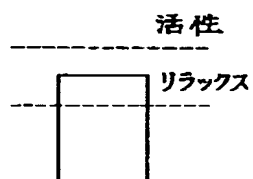
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## DRAWINGS

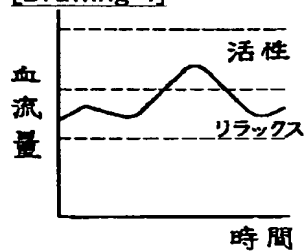
[Drawing 2]



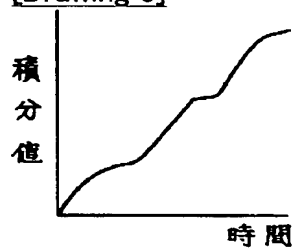
[Drawing 3]



[Drawing 4]

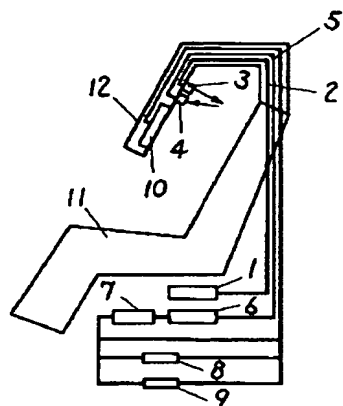


[Drawing 5]

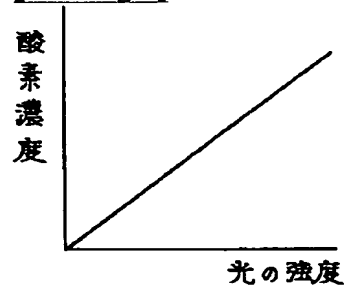


[Drawing 1]

- 1 レーザー光発生部
- 2, 5 光ファイバー
- 3 照射部
- 4 受光部
- 6 フォトダイオード
- 7 血流量演算部
- 8 記憶部
- 9 積分部
- 10 ディスプレイ
- 11 安楽椅子
- 12 ヘッドフード

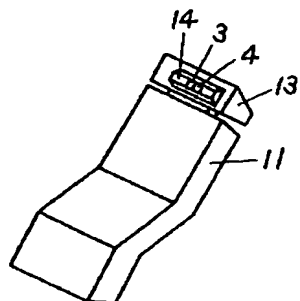


[Drawing 6]



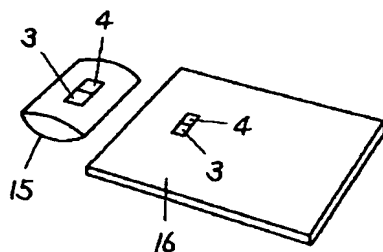
[Drawing 7]

- 3 照射部
- 4 受光部
- 11 安楽椅子
- 13 ヘッドレスト
- 14 突起部



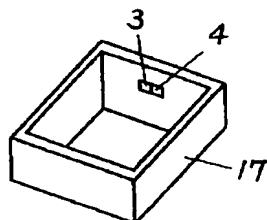
[Drawing 8]

3 照射部  
4 受光部  
15 まくら  
16 パッド



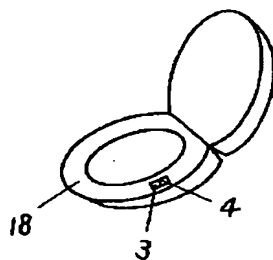
[Drawing 9]

17 浴槽



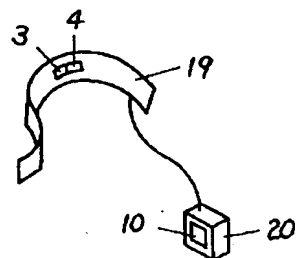
[Drawing 10]

3 照射部  
4 受光部  
18 便座



[Drawing 11]

10 ディスプレイ  
20 制御ユニット



[Translation done.]



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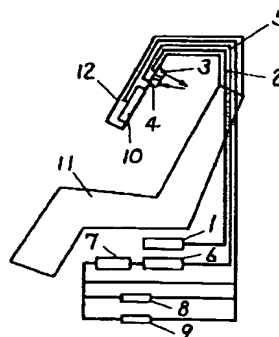
(54) 【発明の名称】 バイオフィードバック装置

(57) 【要約】

【目的】 電極装着による違和感がなく、比較的安価なバイオフィードバック装置を提供することにある。

【構成】 生体に対してある特性をもった電磁波を照射する照射部3と、照射された電磁波の生体からの反射波を検出する受光部4と、前記受光部4からの検出信号をある特定の情報に変換する血流量演算部7と、前記情報を前記生体に対して提示する情報提示手段とからなり、例えばレーザー光のような電磁波を生体に照射し、その反射波の特性に応じてフィードバック信号を出力してバイオフィードバック訓練を行うので、従来のような電極装着による違和感がなく、さらに従来のようにSQUIDのような高価な装置を使用することもない。

- 1 レーザー光発生部
- 2, 5 光ファイバー
- 3 照射部
- 4 受光部
- 6 フォトダイオード
- 7 血流量演算部
- 8 記憶部
- 9 積分部
- 10 ディスプレイ
- 11 安楽椅子
- 12 ヘッドフード



## 【特許請求の範囲】

【請求項 1】生体に対してある特性をもった電磁波を照射する電磁波照射手段と、照射された電磁波の生体からの反射波を検出する電磁波検出手段と、前記電磁波検出手段からの検出信号をある特定の情報に変換する情報変換手段と、前記情報を前記生体に対して提示する情報提示手段とからなるバイオフィードバック装置。

【請求項 2】電磁波照射手段はレーザー光発生部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 3】情報変換手段は、電磁波検出手段からの検出信号に基づき生体の血流量を演算する血流量演算部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 4】情報提示手段は、情報変換手段からの出力を記憶する記憶部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 5】情報提示手段は、情報変換手段からの出力を積分する積分部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 6】情報変換手段は、電磁波検出手段からの検出信号に基づき生体内酸素濃度を演算する酸素濃度演算部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 7】電磁波照射手段は可視光発生部を有した請求項 1 記載のバイオフィードバック装置。

【請求項 8】電磁波検出手段は、照射された電磁波の生体からの透過波を検出する請求項 1 記載のバイオフィードバック装置。

## 【発明の詳細な説明】

## 【0001】

【産業上の利用分野】本発明は、生体のリラクゼーションや脳の活性化等を促進させるバイオフィードバック装置に関するものである。

## 【0002】

【従来の技術】従来この種のバイオフィードバック装置は、例えば特開平 2-168934 号公報のように、脳波電極を生体の頭部 2 に装着し、帯域フィルタで所定の周波数成分のみを選択的に通過させ、帯域フィルタの出力信号に応じて例えば光刺激を生体に伝えていた。また特開平 2-168935 号公報では上記のような電極装着による違和感を避けるために、超伝導膜を用いた SQUID を使用して脳磁波を検出することにより電極を直接生体面に貼り付けることなくフィードバックを行っていた。

## 【0003】

【発明が解決しようとする課題】しかしながら、上記技術のバイオフィードバック装置については、第 1 の引用例では電極と生体面との電氣的接触を確実にする必要性上、ペースト等をつけて電極を直接生体表面に装着しなければならず、装着が面倒でしかも違和感があるといった課題があった。また第 2 の引用例では SQUID が非常に高価で実用的でないといった課題があった。さら

に、使用環境としては双方の引用例ともそれぞれ電氣的あるいは磁氣的なシールドルームが必要となり、使い勝手が悪いといった課題があった。

【0004】本発明の 1 の目的は、上記のような電極装着による違和感がなく、比較的安価なバイオフィードバック装置を提供することにある。

【0005】また本発明の第 2 の目的は、装置の使い勝手を向上させることにある。

## 【0006】

【課題を解決するための手段】本発明は上記の第 1 の目的を達成するために、生体に対してある特性をもった電磁波を照射する電磁波照射手段と、照射された電磁波の生体からの反射波を検出する電磁波検出手段と、前記電磁波検出手段からの検出信号をある特定の情報に変換する情報変換手段と、前記情報を前記生体に対して提示する情報提示手段とからなる。

【0007】また本発明は上記第 2 の目的を達成するために、電磁波照射手段がレーザー光発生部を有する。

【0008】また本発明は上記第 2 の目的を達成するために、情報変換手段が電磁波検出手段からの検出信号に基づき生体の血流量を演算する血流量演算部を有する。

【0009】また本発明は上記第 2 の目的を達成するために、情報提示手段が情報変換手段からの出力を記憶する記憶部を有する。

【0010】また本発明は上記第 2 の目的を達成するために、情報提示手段が情報変換手段からの出力を積分する積分部を有する。

【0011】また本発明は上記第 2 の目的を達成するために、情報変換手段が電磁波検出手段からの検出信号に基づき生体内酸素濃度を演算する酸素濃度演算部を有する。

【0012】また本発明は上記第 2 の目的を達成するために、電磁波照射手段が可視光発生部を有する。

【0013】さらに本発明は上記第 2 の目的を達成するために、電磁波検出手段が照射された電磁波の生体からの透過波を検出する。

## 【0014】

【作用】本発明は上記構成によって以下のように作用する。

【0015】電磁波照射手段が生体に対してある特性をもった電磁波を照射すると、電磁波検出手段が照射された電磁波の生体からの反射波を検出し、情報変換が前記電磁波検出手段からの検出信号をある特定の情報に変換し、情報提示手段が前記情報を前記生体に対して提示する。

【0016】また電磁波照射手段のレーザー光発生部がレーザー光を発生し、電磁波検出手段が照射されたレーザー光の生体からの反射波を検出し、情報変換手段が前記電磁波検出手段からの検出信号をある特定の情報に変換し、情報提示手段が前記情報を前記生体に対して提示

する。

【0017】また情報変換手段の血流量演算部が電磁波検出手段からの検出信号に基づき生体の血流量を演算し、情報提示手段が前記血流量を前記生体に対して提示する。

【0018】また本発明は、情報提示手段の記憶部が情報変換手段からの出力を記憶し、前記出力の時系列情報を生体に対して提示する。

【0019】また情報提示手段の積分部が情報変換手段からの出力を積分し、前記出力の積分値を生体に対して提示する。

【0020】また情報変換手段の酸素濃度演算部が、電磁波検出手段からの検出信号に基づき生体内酸素濃度を演算し、情報提示手段が前記酸素濃度を前記生体に対して提示する。

【0021】また電磁波照射手段の可視光発生部が発生した可視光を生体に照射し、電磁波検出手段が照射された電磁波の生体からの反射波を検出し、情報変換が前記電磁波検出手段からの検出信号をある特定の情報に変換し、情報提示手段が前記情報を前記生体に対して提示する。

【0022】さらに電磁波照射手段が生体に対してある特性をもった電磁波を照射すると、電磁波検出手段が照射された電磁波の生体からの透過波を検出し、情報変換が前記電磁波検出手段からの検出信号をある特定の情報に変換し、情報提示手段が前記情報を前記生体に対して提示する。

【0023】

【実施例】以下本発明の実施例を図面に基いて説明する。図1は本実施例を安楽椅子に組み込んだ場合のブロック図である。図1において、電磁波照射手段はレーザー光発生部1、レーザー光を伝送する光ファイバー2、レーザー光を照射する照射部3から構成される。レーザー光発生部1は小型・軽量・安価という点を考慮し、半導体レーザーを使用している。電磁波検出手段は反射波の受光部4、受光された光を伝送する光ファイバー5、フォトダイオード6から構成される。情報変換手段は受光部4からの検出信号に基づき生体の血流量を演算する血流量演算部7から構成される。情報提示手段は演算された血流量を時系列的に記憶する記憶部8、演算された血流量をある一定時間積分する積分部9、血流量のリアルタイム値と記憶された血流量の時系列値及び前記積分値とを表示するディスプレイ10から構成される。照射部3及び受光部4は安楽椅子11のヘッドフード12に設置される。

【0024】上記実施例の構成による作用を以下に説明する。使用者が安楽椅子11に着席すると、レーザー光発生部1で発生したレーザー光が光ファイバー2を経て照射部3から前頭部に照射される。ここで使用するレーザー光の強度は生体に対して悪影響を及ぼさない程度に

十分強度を低下させてある。一般に、生体組織にレーザー光が照射されると、組織中に流れている血液に照射された分は血流速度に応じてドップラーシフトを受け、波長が変化する。そしてドップラーシフトを受けた光の変調分は血流速度に相当し、その光の強度は移動している血液量に相当するとされており、これら血流速度と血液量の積を演算することにより当該組織の血流量が求められる。したがって、上記の手順に基づき例えば図2の關係に基づき血流量演算部7で頭部の血流量が演算される。演算された血流量信号はディスプレイ10でその信号レベルに応じた画像信号として出力される。例えば図3に示すように、血流量の大きさはバーの高さで表示され、リラクゼーションあるいは活性化を図るには画面上の各々の領域にバーの高さが入るよう、使用者はリアルタイムでフィードバック訓練を行うことができる。また記憶部8により血流量信号は時系列的に記憶され、記憶データは任意の時点でディスプレイ10に表示できる。例えば図4に示すように、横軸に時間、縦軸に血流量をとって前記記憶データがその座標面上に表示される。これにより単にリアルタイムでの訓練だけでなく、時系列的なチェックを行うことができるのでフィードバック訓練の成績向上に寄与できる。さらに、積分部9により血流量信号はある一定時間積分され、この積分値はディスプレイ10に表示される。例えば図5に示すように装置使用開始からの血流量の積分値を表示すれば、その訓練期間の脳の活性状態等をチェックすることができ、次の訓練への判断材料、すなわちリアルタイムではないが少し長いスパンでのフィードバック訓練として有効な情報となる。

【0025】上記作用により、電磁波を生体に照射し、その反射波の特性に応じてフィードバック信号を出力して非接触状態でバイオフィードバック訓練を行うので、従来のような電極装着による違和感がなく、さらに従来のようにSQUIDのような高価な装置を使用することもないので、実用的なバイオフィードバック装置を提供することができるという効果がある。

【0026】また、電磁波照射手段は例えば半導体レーザーのようなレーザー光発生部から構成されているので、従来のSQUIDよりも小型・軽量・安価であるとともに、装置の使用に際して従来のような電氣的磁氣的シールドは必要なく、使い勝手が向上するといった効果がある。

【0027】また、血流量の大小はその組織の活性度合を表していることから、生体に照射されたレーザー光の反射波に基づき生体の血流量を演算し、演算された血流量に応じてフィードバック信号を出力してフィードバック訓練を行うので、従来のように直接脳波や脳磁波を検出する必要がなく使い勝手が向上するといった効果がある。

【0028】また、情報提示手段で記憶された時系列情

報を表示するので、単にリアルタイムでの訓練だけでなく、時系列的なチェックを行うことができるのでフィードバック訓練の成績向上に寄与できるといった効果がある。

【0029】さらに、情報提示手段で演算された積分情報を表示するので、例えば訓練期間の生体の活性状態等をチェックすることができ、次回の訓練への判断材料、すなわちリアルタイムではないが少し長いスパンでのフィードバック訓練として有効な情報となるといった効果がある。

【0030】上記実施例では、情報変換手段は受光部4からの検出信号に基づき生体の血流量を演算する血流量演算部7から構成されていたが、情報変換手段が受光部4からの検出信号に基づき血液中の酸素濃度を演算する酸素濃度演算部を有した構成としてもよい。これはレーザー光の波長を選択することにより生体に照射したレーザー光の一部が生体組織内の血液中のヘモグロビンに吸収され、反射光の強度が変化することに基づくものである。レーザー光としては近赤外線を用いる。図6に血液中の酸素濃度と光の強度との関係を示す。血液中の酸素濃度は血液が流れる細胞の活性度合を表すものと考えられるため、単に血流量を用いるよりは活性度合をよく反映することができる。したがって例えば精神作業中の脳の活性度を高める場合や、ボケ防止といったような生体の活性度合を向上させることを訓練の目的とする場合は、上記のように酸素濃度に応じたフィードバック信号を出力する構成の方が血流量を用いる構成よりも有効な訓練ができるといった効果がある。

【0031】また、上記実施例では電磁波としてレーザー光を使用していたが、レーザー光に限らず例えば可視光等を生体に照射してその反射光の特性に基づいてフィードバック信号を出力する構成としてもよく、レーザー光を発生する構成よりも構成が簡単かつ安全、安価でありより実用的であるといった効果がある。

【0032】また上記実施例では、電磁波検出手段は照射された電磁波の反射波を検出する構成であったが、電磁波検出手段が照射された電磁波の透過波を検出する構成としてもよい。反射波を検出する構成では、例えば皮膚血流のような生体表面及び生体表層の生体情報しか検出できないが、透過波を検出する構成では、生体表面のみならず例えば内臓の活性度合や深部血流といったような生体深部の生体情報までも検出することができるので、例えば消化促進や便秘解消のため内臓の活性を向上させることを訓練の目的とする場合は、上記のような透過波を用いる構成の方が反射波を検出する構成よりもより有効な訓練ができるといった効果がある。

【0033】また上記実施例では、照射部3及び受光部4は安楽椅子11のヘッドフード12に設置されたが、照射部3及び受光部4を図7に示すように安楽椅子11のヘッドレスト13の突起部14に設置されてもよく、

後頭部に電磁波を照射してその反射波に基づいて上記と同様なフィードバック訓練ができる。

【0034】また、本実施例を安楽椅子11に組み込むのではなく、ソファや乗り物の椅子、そして図8～図10に示すように枕15やパッド16等の寝具、浴槽17、便座18等に組み込んだ構成としてもよい。また図11に示すようにヘアーバンド19に照射部3や受光部4を配設し、レーザー光発光部1、フォトダイオード6、情報変換手段、ディスプレイ10等の情報提示手段をコンパクトな制御ユニット20に内蔵した携帯型の構成としてもよい。

【0035】また、電磁波を照射する部位は上記のように頭部に限定するものではなく、生体の他の適当な部位、例えば抹消血管が発達していてフィードバック訓練に適した部位である手部や指先部に照射する構成としてもよい。

【0036】さらに、上記実施例では血流量等のフィードバック信号をディスプレイ10に表示する構成であったが、フィードバック信号をスピーカで音声信号として提示したりLEDの点滅で提示する等の構成であってもよい。

【0037】

【発明の効果】以上説明したように本発明のバイオフィードバック装置によれば次の効果が得られる。

【0038】(1)電磁波を生体に照射し、その反射波の特性に応じてフィードバック信号を出力して非接触状態でバイオフィードバック訓練を行うので、従来のような電極装着による違和感がなく、さらに従来のようにSQUIDのような高価な装置を使用することもないので、実用的なバイオフィードバック装置を提供することができるといった効果がある。

【0039】(2)電磁波照射手段は例えば半導体レーザーのようなレーザー光発生部から構成されているので、従来のSQUIDよりも小型・軽量・安価であるとともに、装置の使用に際して従来のような電氣的磁氣的シールドは必要なく、使い勝手が向上するといった効果がある。

【0040】(3)血流量の大小はその組織の活性度合を表していることから、生体に照射されたレーザー光の反射波に基づき生体の血流量を演算し、演算された血流量に応じてフィードバック信号を出力してフィードバック訓練を行うので、従来のように直接脳波や脳磁波を検出する必要がなく使い勝手が向上するといった効果がある。

【0041】(4)情報提示手段で記憶された時系列情報を表示するので、単にリアルタイムでの訓練だけでなく、時系列的なチェックを行うことができるのでフィードバック訓練の成績向上に寄与できるといった効果がある。

【0042】(5)情報提示手段で演算された積分情報

を表示するので、例えば訓練期間の生体の活性状態等をチェックすることができ、次回の訓練への判断材料、すなわちリアルタイムではないが少し長いスパンでのフィードバック訓練として有効な情報となるといった効果がある。

【0043】(6) 血液中の酸素濃度は血液が流れる細胞の活性度合を表すものと考えられることから、生体に照射されたレーザー光の反射波に基づき生体の血液中の酸素濃度を演算し、演算された酸素濃度に応じてフィードバック信号を出力してフィードバック訓練を行うので、従来のように直接脳波や脳磁波を検出する必要がなく使い勝手が向上するといった効果があるとともに、単に血流量を用いるよりは活性度合をよく反映することができるので、例えば精神作業中の脳の活性度を高める場合や、ボケ防止といったような生体の活性度合を向上させることを訓練の目的とする場合は、血流量を用いる構成よりも有効な訓練ができるといった効果がある。

【0044】(7) 照射する電磁波としてレーザー光に限らず可視光を生体に照射してその反射光の特性に基づいてフィードバック信号を出力する構成とすると、レーザー光を発生する構成よりも構成が簡単かつ安全、安価なのでより実用的であるといった効果がある。

【0045】(8) 電磁波検出手段が照射された電磁波の透過波を検出する構成とすると、反射波を検出する構成では、例えば皮膚血流のような生体表面及び生体表層の生体情報しか検出できないが、透過波を検出する構成では、生体表面のみならず例えば内臓の活性度合や深部血流といったような生体深部の生体情報までも検出することができるので、例えば消化促進や便秘解消のため内臓の活性を向上させることを訓練の目的とする場合は、上記のような透過波を用いる構成の方が反射波を検出する構成よりもより有効な訓練ができるといった効果がある。

【図面の簡単な説明】

【図1】本発明の実施例におけるバイオフィードバック装置のブロック図

【図2】光の強度と変調分と血流量との関係を示した図

【図3】同実施例の情報提示手段における血流量の表示\*

\* の一例を示した図

【図4】同実施例の情報提示手段における血流量の時系列表示の一例を示した図

【図5】同実施例の情報提示手段における血流量の積分表示の一例を示した図

【図6】光の強度と酸素濃度との関係を示した図

【図7】本発明をヘッドレストに組み込んだ場合の実施例における外観斜視図

【図8】本発明を寝具に組み込んだ場合の実施例における外観斜視図

【図9】本発明を浴槽に組み込んだ場合の実施例における外観斜視図

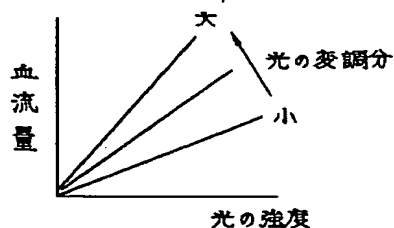
【図10】本発明を便座に組み込んだ場合の実施例における外観斜視図

【図11】本発明を携帯型にした場合の実施例における外観斜視図

【符号の説明】

- 1 レーザー光発生部
- 2 光ファイバー
- 3 照射部
- 4 受光部
- 5 光ファイバー
- 6 フォトダイオード
- 7 血流量演算部
- 8 記憶部
- 9 積分部
- 10 ディスプレイ
- 11 安楽椅子
- 12 ヘッドフード
- 13 ヘッドレスト
- 14 突起部
- 15 枕
- 16 バッド
- 17 浴槽
- 18 便座
- 19 ヘアバンド
- 20 制御ユニット

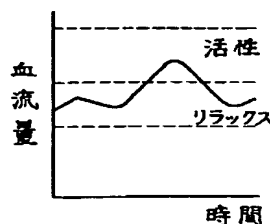
【図2】



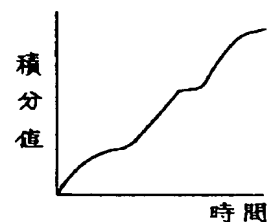
【図3】



【図4】

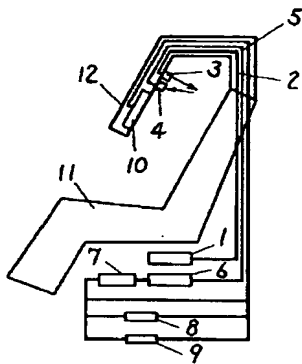


【図5】



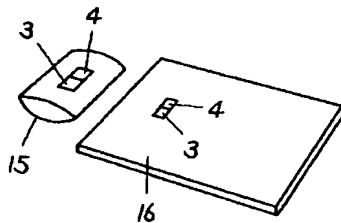
【図1】

- 1 レーザー光発生部
- 2, 5 光ファイバー
- 3 照射部
- 4 受光部
- 6 フォトダイオード
- 7 血流量演算部
- 8 記憶部
- 9 積分部
- 10 ディスプレイ
- 11 安楽椅子
- 12 ヘッドフード

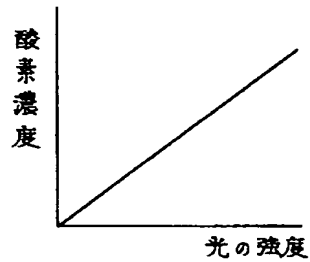


【図8】

- 3 照射部
- 4 受光部
- 15 まくら
- 16 パッド

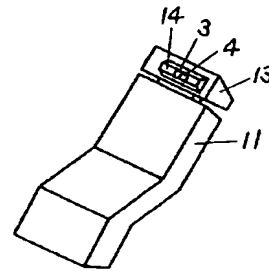


【図6】



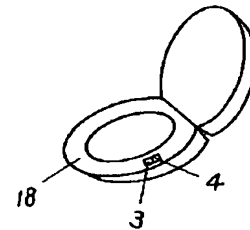
【図7】

- 3 照射部
- 4 受光部
- 11 安楽椅子
- 13 ヘッドレスト
- 14 突起部



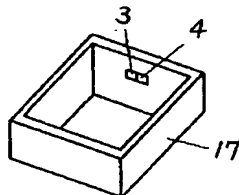
【図10】

- 3 照射部
- 4 受光部
- 18 便座



【図9】

17 浴槽



【図11】

- 10 ディスプレイ
- 20 制御ユニット

